DIONEX

CHROMATOGRAPHY

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INSTALLATION INSTRUCTIONS and TROUBLESHOOTING GUIDE

for the

IONPAC® AG4A-SC GUARD COLUMN

(2 x 50 mm, P/N 043126)
(4 x 50 mm, P/N 043175)

IONPAC® AS4A-SC ANALYTICAL COLUMN

(2 x 250 mm, P/N 043125)
(4 x 250 mm, P/N 043174)

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INITIAL INSPECTION

As soon as you unpack the IonPac® AS4A-SC Analytical Column or the IonPac AG4A-SC Guard Column, inspect it for shipping damage. Because many carriers limit the claim period to 10 days after the delivery date, DIONEX recommends that you report any shipping damage to the incoming carrier immediately. To request help in assessing shipping damage, or to report a missing or damaged part, contact the DIONEX Regional Office nearest you (see Section 12, DIONEX Regional Offices).

COLUMN WARRANTY

The 90-day column warranty is in effect from the day the IonPac AS4A-SC Analytical Column or the IonPac AG4A-SC Guard Column is shipped from DIONEX. After verifying that it was not damaged in transit, install the column in the system and test it by making several injections of the standard used to obtain the test chromatogram. The test chromatogram is shipped with the column. Contact the nearest DIONEX Regional Office (see Section 12, DIONEX Regional Offices) if the performance of the column is unsatisfactory.

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SECTION 1 - INTRODUCTION TO IONPAC AS4A-SC ION CHROMATOGRAPHY

The IonPac® AS4A-SC 2mm (P/N 043125)/4mm (P/N 043174) Analytical Columns are designed for the analysis of anions and organic acids using carbonate/bicarbonate or borate eluent systems. For many isocratic applications sodium carbonate/bicarbonate eluent systems are used. Borate eluents are used instead of carbonate/bicarbonate eluents for gradient applications because the lower background conductivity of the suppressed borate eluents produces shallower gradient ramps. The advantage of both of these eluent systems is that much less care must be taken to prevent contamination from carbon dioxide in the air compared to hydroxide eluent systems.

The AS4A-SC 2mm can be operated at flow rates up to 0.75 mL/min with eluents containing 0 - 100% organic solvents. The AS4A-SC 4mm can be operated at flow rates up to 3.0 mL/min with eluents containing 0 - 100% organic solvents. The columns are stable between pH 0 and 14. PEEK (polyetheretherketone) is used to make column hardware. PEEK has excellent chemical resistance to most organic solvents and inorganic solutions. Concentrated sulfuric acid and concentrated nitric acid will attack PEEK. Tetrahydrofuran at concentrations of greater than 20% is not compatible with PEEK systems. The AS4A-SC 2mm and 4mm Analytical Columns have minimum efficiencies of 4,000 plates/column for sulfate, under standard operating conditions. The AS4A-SC 2mm operates at a backpressure between 1,000 - 1,400 psi at 0.50 mL/min with standard eluent. The AS4A-SC 4mm operates at a backpressure between 1,000 - 1,400 psi at 2.0 mL/min with standard eluent. However, both columns are capable of operating at backpressures up to 4,000 psi.

The AS4A-SC is composed of a 12 µm highly cross-linked polyethylvinylbenzene/ divinylbenzene substrate agglomerated with anion exchange latex that has been completely aminated. The ion exchange capacity of the 2 x 250 mm analytical column is 5 µeq/column. The ion exchange capacity of the 4 x 250 mm analytical column is 20 µeq/column. The latex particles are permanently bonded to the substrate surface by electrostatic and van der Waals interactions.

Always remember that assistance is available for any problem that may be encountered during the shipment or operation of DIONEX instrumentation and columns through any of the DIONEX Regional Offices listed in Section 12, DIONEX Regional Offices. If you feel that any of the sections in these Installation Instructions and Troubleshooting Guide is unclear, incomplete or are not needed, please write down your comments on the Reader's Comments Form at the end of this manual and return the form to us.

This manual assumes that you are familiar with the installation and operation of the DIONEX Ion Chromatograph (IC) and the Anion MicroMembrane Suppressor. If you do not understand the operation of the system, take the time to familiarize yourself with the various system components before beginning an analysis.

The IonPac AS4A-SC Analytical and AG4A-SC Guard Columns have 10-32 threaded PEEK end fittings for use with ferrule/bolt liquid line fittings. If your system is otherwise configured, refer to Section 10 - Installation of DIONEX Liquid Line Fittings.

SECTION 2 - COMPARISON OF 2mm AND 4mm ION CHROMATOGRAPHY SYSTEMS

This section describes the performance comparison of 2mm ID analytical columns and systems to 4mm ID analytical columns and systems. Note the similarities and differences listed below for the two column and system types.

2.1 GENERAL OPERATING CONDITIONS

Sample Loop Volume:	10 µL* 2.5 µL**
Analytical Column:	IonPac AS4A-SC 4mm Analytical Column* IonPac AS4A-SC 2mm Analytical Column**
Eluent:	1.8 mM Na_2CO_3/1.7 mM $NaHCO_3$
Eluent Flow Rate:	2.0 mL/min* 0.5 mL/min**
Suppressor:	Anion MicroMembrane Suppressor, AMMS-II* Anion MicroMembrane Suppressor, AMMS (2mm)**
Regenerant:	50 mN H_2SO_4
Regenerant Flow Rate:	3 - 5 mL/min
Expected Background Conductivity:	15 - 20 µS

* A condition used in Chromatogram 6a. in Figure 6 below.

** A condition used in Chromatogram 6b. in Figure 6 below.

2.2 Example CHROMATOGRAMS

1. Fluoride (1.0 mg/L)
2. Chloride (1.5 mg/L)
3. Bromide (10.0 mg/L)
4. Nitrate (15.0 mg/L)
5. Phosphate (20.0 mg/L)
6. Sulfate (25.0 mg/L)

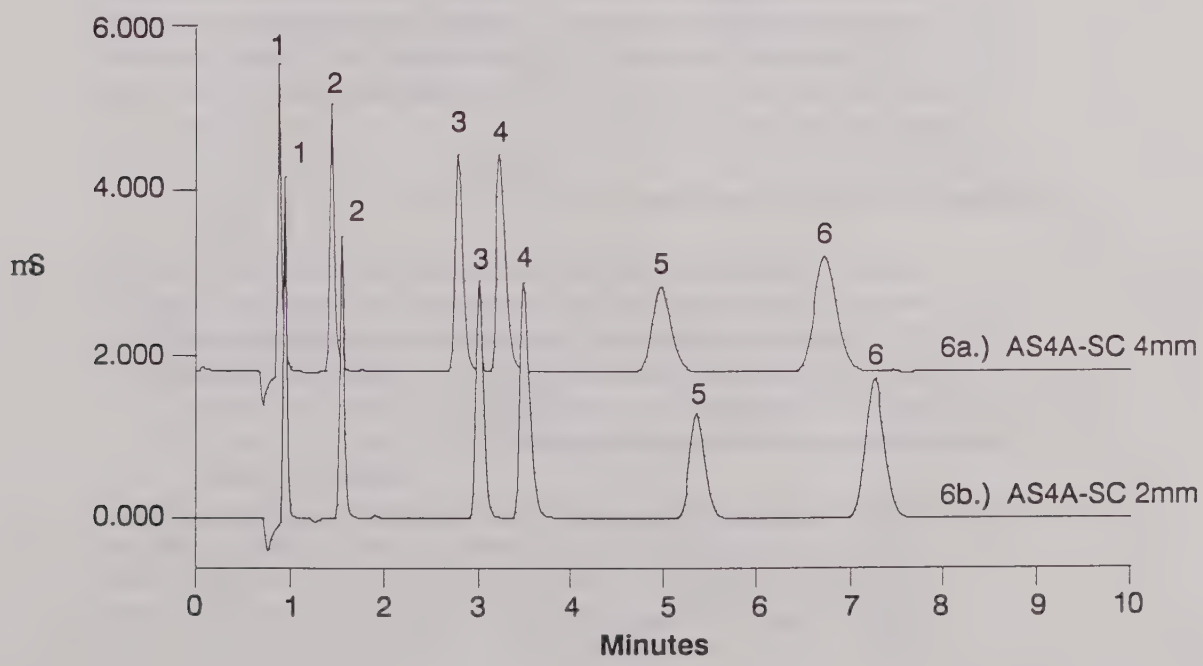


Figure 1

Comparison of 2mm and 4mm Operation

NOTE

A DX-300 HPLC pump is required for 2mm gradient chromatography. The Gradient Pump Module (GPM-2) can be used for 2mm isocratic chromatography at flow rates of 0.5 mL/min or greater but not 2mm gradient chromatography.

DIONEX 2mm systems have been especially designed with the reduced dead volume required for high performance operation of 2mm columns. Properly configured, 2mm columns and systems not only produce efficiencies and concentration sensitivities equivalent to 4mm columns and systems but also improve on the economy of operation, the ability to suppress eluents with higher concentrations and provide increased mass sensitivities. The proper configuration of 2mm system injection volume, mass loading, system void volume and flow rate is based the ratio of the 2mm to 4mm column cross-sectional area which is a factor of 1/4.

A. Efficiencies are equivalent

The particle size of the packing material determines the column efficiency. Since both column formats contain the same packing material, they have equivalent efficiencies.

B. Retention times are equivalent

Both systems employ the same column packing material and the same eluent. The difference in column volume is compensated for by proportionally reducing the flow rate for the 2mm systems so that the linear velocity of the eluent is the same in both 4mm and 2mm columns.

C. System pressures are equivalent

Column backpressure is proportional to the eluent flow rate and inversely proportional to the cross sectional area of the column. The difference in column cross sectional area is compensated for by proportionally reducing the flow rate for the 2mm systems.

D. Concentration sensitivities are equivalent

The ratio of peak volume of an analyte to the injection volume should be the same for both 2mm and 4mm systems that are properly configured. Since the detectors see the same concentration of analyte, the concentration sensitivities are the same.

E. Reduced Mobile Phase Consumption - 2mm Columns

Mobile phase consumption is significantly reduced. Typical flow rates for 2mm columns are 0.2 - 0.5 mL/min. Instrument operation therefore is more economical through reduced eluent and labor costs.

F. Reduced Waste Disposal Problems - 2mm Columns

G. Extended AutoRegen Regenerant Cartridge Life - 2mm Columns

The typical lifetime of an AutoRegen Regenerant Cartridge can be increased 2 - 4 fold over standard 4mm applications. To realize the full extension of the AutoRegen Regenerant Cartridge lifetime, it is necessary to scale down the regenerant flow rate by a fraction equal to the ratio of the 2mm system eluent flow rate divided by the 4mm system eluent flow rate.

H. Ability to Suppress Higher Eluent Concentrations - 2mm Columns

Higher chemical suppression capacity expands the analytical versatility of the Ion Chromatograph. The Anion MicroMembrane Suppressor (AMMS (2mm), P/N 043106) has the ability to suppress eluent concentrations much higher than the limiting suppressible eluent concentrations in 4mm systems because of the much lower 2mm system eluent flow rates. This requires that the regenerant flow rate is maintained at the original 4mm system operating flow rate. This capability permits the use of higher concentration gradients for the elution of highly charged molecules such as polysulfonates, polyphosphonates and polyphosphates. Typically a 1.5 - 2.0 fold increase in suppression capacity is observed compared to the 4mm column systems.

NOTE

If the regenerant flow rate is scaled down as described above in Section G. - Extended AutoRegen Regenerant Cartridge Life - 2mm Columns, the maximum suppressible eluent concentration limit will be the same as in 4mm system operation.

E. Higher Mass Sensitivity - 2mm Columns

The same chromatographic concentration sensitivity is obtained using an injection volume that is 25% of the typical injection volumes used with the 4mm column systems. When using a flow rate that is one-fourth of the flow rate used with the 4mm column, the analyte band in the 2mm column has a concentration equivalent to the analyte band in the 4mm column but contains only one-fourth the mass of analyte. This significantly improves the mass sensitivity of the 2mm column systems.

SECTION 3 - COLUMN OPERATION SUMMARY

	2mm System Operation Summary	4mm System Operation Summary
3.1 ELUENT FLOW RATE	Typically 0.5 mL/min	Typically 2.0 mL/min
3.2 REGENERANT FLOW RATE	25 - 100% of 4mm system	Typically 3 - 5 mL/min See Document No. 034449
3.3 ANION MICROMEMBRANE SUPPRESSOR	Anion MicroMembrane Suppressor (2mm) (P/N 043016)	Anion MicroMembrane Suppressor-II (P/N 043074)
3.4 ANION TRAP COLUMN	ATC (2mm) (P/N 043131)	ATC-1 (P/N 037151)
3.5 INJECTION LOOP	2 - 15 µL (1/4 of the volume of the 4mm column)	10 - 50 µL

Use the Rheodyne Microinjection Valve, Model No. 9126 (DIONEX P/N 044697) for full loop injections <15 µL.

	2mm System Operation Summary	4mm System Operation Summary
3.6 SYSTEM VOID VOLUME		
	Eliminate switching valves, couplers and the GM-3 Gradient Mixer.	Minimize dead volumes. Switching valves, couplers can be used.
	No Gradient Mixer is required for the DX-300 HPLC Pump when performing gradient analysis.	The GM-3 Gradient Mixer should be used for gradient analysis on systems other than the DX-300 HPLC Pump.
3.7 DETECTORS		
	VDM-II Cell (2.0 µL) (P/N 043120)	VDM-II Cell (10 µL) (P/N 043113)
	CDM-II Cell (P/N 042770)	CDM-II Cell (P/N 042770)
	DIONEX Backpressure Regulator 75 psi rating (P/N 039760) or Tubing (see Table 1) Ensure 50-75 psi backpressure.	DIONEX Backpressure Regulator 75 psi rating (P/N 039760) or Tubing (see Table 1) Ensure 50-75 psi backpressure.
	TS-2 (P/N 043117) Replace the TS-1 with the TS-2 which has been optimized for 2mm operation.	Either the TS-1 or the TS-2 can be used.

TABLE 1

Tubing Backpressures

Tubing ID (inches)	H_2O Backpressure at 1 mL/min
0.005	111.4 psi/ft
0.007	29.0 psi/ft
0.010	7.0 psi/ft
0.012	3.4 psi/ft

4.1 SYSTEM REQUIREMENTS

4.1.1 SYSTEM REQUIREMENTS FOR 2mm OPERATION

The IonPac AS4A-SC 2mm Guard and Analytical Columns are designed to be run on the following DIONEX Ion Chromatographs equipped with suppressed conductivity detection. Isocratic analyses at flow rates of 0.5 mL/min or greater can be performed on a Gradient Pump Module (GPM-2) or an advanced Gradient Pump (AGP) with standard pump heads. For isocratic analyses at flow rates below 0.5 mL/min and gradient analyses, a Microbore Advanced Gradient Pump must be employed.

NOTE

The Gradient Pump Module (GPM-2) can be used for 2mm isocratic chromatography down to 0.5 mL/min but CANNOT be used for 2mm gradient chromatography.

4.1.2 SYSTEM REQUIREMENTS FOR 4mm OPERATION

The IonPac AS4A-SC 4mm Guard and Analytical Columns are designed to be run on any DIONEX Ion Chromatograph equipped with suppressed conductivity detection. Gradient methods and methods requiring solvent containing eluents should be performed on a system having a Gradient Pump Module (GPM-2) or an Advanced Gradient Pump (AGP) with standard pump heads.

4.1.3 SYSTEM VOID VOLUME

When using 2mm columns, it is particularity important to minimize system void volume. The system void volume should be scaled down to at least 1/4 of the system volume in a standard 4mm system. For best performance, all of the tubing installed between the injection valve and detector should be 0.005" (P/N 044221) ID PEEK tubing. 0.010" ID PEEK tubing (P/N 042260) or 0.012" Tefzel tubing (see Section 11, Important DIONEX Part Numbers) may be used but peak efficiency will be compromised which may also result in decreased peak resolution. Minimize the lengths of all connecting tubing and remove all unnecessary switching valves and couplers. If you need assistance in properly configuring your system contact the nearest DIONEX Regional Office (see Section 12, DIONEX Regional Offices).

4.2 INSTALLING THE ANION TRAP COLUMN

When performing a gradient anion exchange application, a borate eluent system should be used instead of a carbonate system because of its low background conductivity. An IonPac Anion Trap Column (ATC (2mm), P/N 043131 or ATC-1 (4mm), P/N 037151) should be installed between the Gradient Pump and the injection valve. Remove the high pressure

Gradient Mixer if present . The ATC is filled with high capacity anion exchange resin which helps to minimize the baseline shift caused by increasing anionic contaminant levels in the eluent as the ionic concentration of the eluent is increased over the course of the gradient analysis.

To install the ATC (2mm) or ATC-1 (4mm), complete the following steps:

A. Remove the Gradient Mixer, if installed between the gradient pump pressure transducer and the injection valve.

B. Connect the gradient pump directly to the ATC. Connect a waste line to the ATC outlet and direct the line to a waste container.

C. Flush the ATC with 200 mL of 70 mM $Na_2B_4O_7$ at a flow rate of 0.5 mL/min when using the ATC (2mm) or 2.0 mL/min when using the ATC-1 (4mm).

D. Rinse the ATC with the strongest eluent that will be used during the gradient analysis.

E. After flushing the ATC with eluent, connect the ATC to the eluent line that is connected to the injection valve.

The background conductivity of your system should be less than 7 mS when $Na_2B_4O_7$ is being pumped through the chromatographic system with the AMMS in-line and properly functioning. The baseline shift should be no greater than 10 µS during a borate gradient eluent concentration ramp from 0 to 70 mM $Na_2B_4O_7$. If the baseline shifts are greater than 10 µS, the ATC should be cleaned using steps A - E above.

The ATC can be flushed, at the end of each operating day, to remove any impurities that may have accumulated on it. This will minimize periodic maintenance and lost data.

A. Flush the ATC with 30 mL of 70 mM $Na_2B_4O_7$.

B. Prior to next day use of the chromatographic system, flush the ATC with 30 mL of the strongest eluent used in the gradient program.

See Section 8.2.2, A Contaminated Anion Trap Column, ATC, for instructions on cleaning a contaminated Anion Trap Column.

4.3 SAMPLE CONCENTRATION

The IonPac AG4A-SC 2mm or 4mm Guard Column can be used for trace anion concentration work primarily in high purity water analysis. The function of AG4A-SC Guard Column in these applications is to strip ions from a measured volume of a relatively clean aqueous sample matrix. This process "concentrates" all anionic analyte species onto the AG4A-SC Guard Column leading to a lowering of detection limits by 2-5 orders of magnitude. The unique advantage of the AG4A-SC Guard Column for the analytical chemist

in these applications is the capability of performing routine trace analyses of sample matrix ions at µg/L levels without extensive and laborious sample pretreatment.

For a detailed discussion of anion concentration techniques, refer to Section 3, Operation, of the Trace Anion Concentrator (TAC-2) Column Installation Instructions and Troubleshooting Guide (Document No. 034467).

CAUTION

IonPac Trace Anion Concentrator (TAC-2) Column (P/N 043101) is designed for 4mm systems. Although the principles of sample concentration are the same for both the AG4A-SC 2mm and the TAC-2, the large void volume in the TAC-2 makes it unacceptable for use with 2mm systems.

4.4 THE INJECTION LOOP

Table 2

Smallest Injectable Volumes (µL)

Valve Type	Using 0.012" ID Tefzel® Tubing	Using 0.007" ID Tefzel® Tubing	Using 0.010" ID PEEK Tubing	Using 0.005" ID PEEK Tubing
DIONEX BF2 Valve (8 µL Internal Volume) (10 cm Loop)	15.2	10.5	13.1	9.2
DIONEX MicroInject Valve (10.5 µL Internal Volume) (14 cm Loop)	20.5	14.0	17.6	12.2
Rheodyne Microinjection Valve Model 9126 (0.8 µL Internal Volume) (10 cm Loop)	8.0	3.3	5.9	2.0

4.4.1 THE 2mm SYSTEM INJECTION LOOP, 2 - 15 µL

For most applications on a 2mm analytical system, a 2 - 15 µL injection loop is sufficient. Generally, you should not inject more than 2.5 nanomoles (25 - 50 ppm) of any one analyte onto a 2mm analytical column. Injecting larger volumes of samples can result in overloading the column which can affect the detection linearity. The AS4A-SC 2mm requires a microbore HPLC system configuration. Install an injection loop one-fourth or less (< 15 µL) of the loop volume used with a 4mm analytical system (see Section 5.3, Detector, requirements for 2mm operation for more details).

4.4.2 THE 4mm SYSTEM INJECTION LOOP, 10 - 50 µL

For most applications on a 4mm analytical system, a 10 - 50 µL injection loop will be sufficient. Generally, do not inject more than 10 nanomoles (100 - 200 ppm) of any one analyte onto the 4mm analytical column. Injecting larger volumes of samples can result in overloading the column which can affect the detection linearity. This phenomenon will be more prevalent at higher concentrations of the analytes of interest.

4.5 IONPAC AG4A-SC GUARD COLUMNS

An IonPac AG4A-SC Guard Column is normally used with the IonPac AS4A-SC Analytical Column. Retention times will increase by approximately 20% when a guard column is placed in-line prior to the analytical column. A guard is placed prior to the analytical column to prevent sample contaminants from eluting onto the analytical column. It is easier to clean or replace a guard column than it is an analytical column.

4.6 ANION MICROMEMBRANE SUPPRESSOR REQUIREMENTS

An Anion MicroMembrane Suppressor should be used for applications that require suppressed conductivity detection. It is compatible with all solvents and concentrations with which the systems and columns are compatible.

If you are installing an IonPac AS4A-SC 4mm Analytical Column, use an AMMS-II (P/N 043074).

If you are installing an IonPac AS4A-SC 2mm Analytical Column, replace either the AMMS-I or AMMS-II with an AMMS (2mm) (P/N 043106).

This manual assumes that you are familiar with the installation and operation of the Ion Chromatograph and Anion MicroMembrane Suppressor. If you do not understand the operation of your system, take the time to familiarize yourself with the operator's manuals for the products before beginning an analysis. For detailed information on the operation of the Anion MicroMembrane Suppressor, see Document No. 034449-02, the Installation Instructions and Troubleshooting Guide for the Anion MicroMembrane Suppressor-II, the AMMS-II and the Anion MicroMembrane Suppressor (2mm), the AMMS (2mm).

4.7 DETECTOR REQUIREMENTS

Consult Section 5.5, Detector, for 2mm system detector cell and thermal stabilizer requirements, for 2mm column operation.

4.8 ELUENT STORAGE

IonPac AS4A-SC columns are designed to be used with borate (gradient or isocratic analysis) or bicarbonate/carbonate (isocratic analysis only) eluent systems. Storage under a helium atmosphere ensures contamination free operation and proper pump performance (nitrogen can be used if eluents do not contain solvents).

4.9 USING AUTOREGEN

To minimize the baseline shift when performing an analysis that requires a hydroxide or borate gradient, a high regenerant flow rate (10 - 15 mL/min) is required. To save regenerant preparation time and reduce regenerant consumption and waste, DIONEX recommends using an AutoRegenr Accessory (P/N 039594).

When using an AutoRegen System, specific contaminants are continuously removed from the regenerant solution to restore it to the correct ionic state. It is necessary however to replace the regenerant on a regular basis. If solvents are used in the eluent, ionic contaminants from the solvent component of the eluent which are not removed by the Anion AutoRegen Regenerant Cartridge may slowly accumulate in the regenerant. This results in slowly increasing background conductivity. The rate at which the background conductivity increases versus the required analysis sensitivity will determine how often the regenerant must be changed.

It is not necessary to change the Anion AutoRegen Regenerant Cartridge until it is completely expended and a sudden jump to very high background conductivity is observed. For more detailed information on the use of AutoRegen Regenerant Cartridges, see the Installation Instructions and Troubleshooting Guide for the AutoRegen Regenerant Cartridge Refills (Document No. 032852).

SECTION 5 - 2mm SYSTEM REQUIREMENT SUMMARY

5.1 SYSTEM VOID VOLUME

For efficient 2mm column operation, it is crucial to minimize system void volume. Ensure that all tubing installed between the injection valve and the detector has an internal diameter of 0.012" (Tefzel) or less. 2mm systems are shipped with 0.005" ID PEEK tubing. Minimize the lengths of connecting tubing. Do not use switching valves or couplers that have large dead volumes that cause peak broadening. Do not use a high pressure Gradient Mixer (GM-3) between the Gradient Pump Module (GPM) and the injection valve if performing gradients.

5.2 THE ANION TRAP COLUMN

Replace the Anion Trap Column, ATC-1 with the Anion Trap Column, ATC (2mm).

5.3 SAMPLE CONCENTRATION

The IonPac AG4A-SC 2mm Guard Column can be used for trace anion concentration. For a detailed discussion of anion concentration techniques, refer to Section 3, Operation, of the Trace Anion Concentrator (TAC-2) Column Installation Instructions and Troubleshooting Guide (Document No. 034467) but note the Caution Note in Section 4.3, Sample Concentration of this manual.

5.4 THE INJECTION LOOP

Install an injection loop one-fourth or less (i.e. 1 - 15 µL) of the loop volume used with your 4mm analytical system. For injection volumes < 15 µL, the Rheodyne Microinjection Valve, Model No. 9126 (DIONEX P/N 044697) is required (see Table 2, Smallest Injectable Volumes (µL)).

5.5 ANION MICROMEMBRANE SUPPRESSOR

The Anion MicroMembrane Suppressor, AMMS (2mm), (P/N 043106) is designed for 2mm columns. Be sure to replace the standard Anion MicroMembrane Suppressor (AMMS-II or AMMS-I).

5.6 DETECTOR

If you are using a conductivity detector with a CDM-I cell replace it with the appropriate CDM-II cell. If high sensitivity is required, replace the TS-1 with a TS-2 Thermal Stabilizer (P/N 043117) which has been optimized for 2mm chromatography. Install a waste line from

the conductivity cell that generates approximately 50 psi backpressure or use the DIONEX Backpressure Regulator (P/N 039760).

If you are using a Visible Detector Module (VDM-II) ensure that it is equipped with a 2.0 µL cell required for 2mm operation (P/N 043120).

5.7 ELUENT FLOW RATE

Use the same eluent concentration used for the standard 4mm system but reduce the flow rate to one-fourth of the flow rate used on the 4mm column system. The typical flow rate of the AS4A-SC 2mm is 0.50 mL/min.

5.8 REGENERANT

In general, use the same regenerant flow rate as used in the standard 4mm column application to obtain maximum suppression capacity. For many analyses in which high suppression capacity is not required, the regenerant flow rate can be reduced by a factor equal to the reduction in the eluent flow rate (compared to the standard 4mm column application) to conserve regenerant. This is especially useful if a pressurized vessel is being used rather than an AutoRegen Accessory Unit and reduced regenerant flow rates in the AutoRegen Accessory Unit will extend the lifetime of the AutoRegen Regenerant Cartridge. For detailed information on regenerant flow rates and the operation of the Anion MicroMembrane Suppressor, see Document No. 034449-02, the Installation Instructions and Troubleshooting Guide for the Anion MicroMembrane Suppressor-II, the AMMS-II and Anion MicroMembrane Suppressor (2mm), the AMMS (2mm).

6.1 GENERAL OPERATING CONDITIONS

The selectivity of the IonPac AS4A-SC 2mm Analytical Column is the same as the IonPac AS4A-SC 4mm Analytical Column. Both columns have been designed to separate F^-, Cl^-, NO_2^-, Br^-, NO_3^-, HPO_4^{2-} and SO_4^{2-} isocratically in less than 8 minutes. The AS4A-SC columns have a highly cross-linked (55%), microporous, hydrophobic core resin that has been agglomerated with totally permeable latex particles that are completely aminated. The latex particles carry the actual ion exchange function - an alkanol quaternary ammonium group. The polymeric structure of the packing material makes the AS4A-SC compatible with pH 0-14 eluents and organic solvents. The AS4A-SC can be used with any suppressible ionic eluent that does not exceed the capacity of the Anion MicroMembrane Suppressor.

Use the same eluent concentrations with the AS4A-SC 2mm that are used with the AS4A-SC 4mm but reduce the flow rate to one-fourth of the flow rate used on the 4mm system.

6.1.1 IONPAC AS4A-SC OPERATION PRECAUTIONS

CAUTION

Filter and Degas Eluents
Filter Samples
0.75 mL/min Maximum Flow Rate for AS4A-SC 2mm
3.00 mL/min Maximum Flow Rate for AS4A-SC 4mm

6.1.2 SOLVENTS

The AS4A-SC can withstand all common HPLC solvents in a concentration range of 0 - 100%. However, solvents and water should be premixed in concentrations to allow proper mixing by the gradient pump and to minimize outgassing. Ensure that all of the inorganic chemicals are soluble in the highest solvent concentration to be used during the analysis.

One of the benefits of the IonPac AS4A-SC Analytical Column is the ability to use most common HPLC solvents from concentrations of 0% to 100% as mobile phase modifiers in ion exchange separations. When using a solvent in an ionic eluent, column generated backpressures will depend on the solvent used, concentration of the solvent, the ionic strength of the eluent and the flow rate used. As Figure 2 shows, the column back pressure will vary as the composition of water-methanol and water-acetonitrile mixture varies.

The practical backpressure limit for the IonPac AS4A-SC columns is 4,000 psi. Therefore, any combination of the above contributions to operating backpressure that totals up to 4,000 psi can be used.

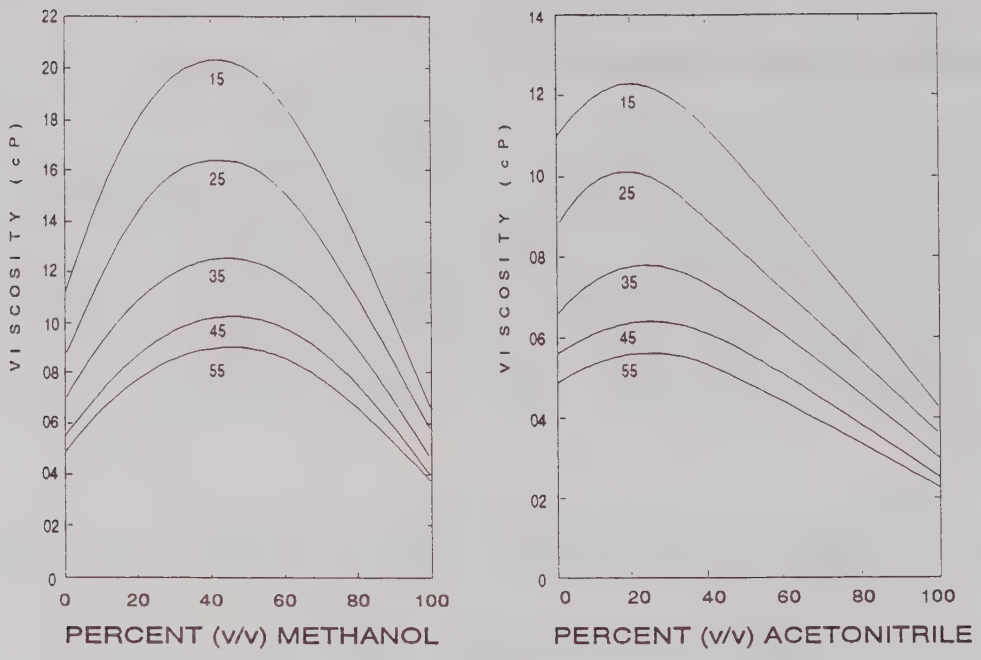


Figure 2

Variation of solvent viscosity with changing temperature and composition of water-solvent mixtures. The composition is expressed as percent (v/v) at 20.5°C and the viscosity is in centipoise. The temperature at which the viscosity was measured is indicated below each curve.*

Table 3

HPLC Solvents for Use with IonPac AS4A-SC Columns

Solvent	Maximum Operating Concentration
Acetonitrile	100%
Methanol	100%
2-Propanol	100%
Tetrahydrofuran	20%

* C. Horvath, Ed., "High Performance Liquid Chromatography. Advances and Perspectives", Vol. 2, p. 193-194, New York, 1980.

6.2 CHEMICAL REQUIREMENTS

Obtaining reliable, consistent and accurate results requires eluents that are free of ionic and spectrophotometric impurities. Chemicals, solvents and deionized water used to prepare eluents must be of the highest purity available. Low trace impurities and low particle levels in eluents also help to protect your ion exchange columns and system components. DIONEX cannot guarantee proper column performance when the quality of the chemicals, solvents and water used to prepare eluents has been compromised.

6.2.1 INORGANIC CHEMICALS

Reagent Grade inorganic chemicals should always be used to prepare ionic eluents. Whenever possible, inorganic chemicals that meet or surpass the latest American Chemical Society standard for purity should be used. These inorganic chemicals will detail the purity by having an actual lot analysis on each label.

6.2.2 SOLVENTS

Since solvents used with the IonPac AS4A-SC columns are added to ionic eluents to modify the ion exchange process or improve sample solubility, the solvents used must be free of ionic impurities. However, since most manufacturers of solvents do not test for ionic impurities, it is important that the highest grade of solvents available be used. Currently, several manufacturers are making "ultrahigh" purity solvents that are compatible for HPLC and spectrophotometric applications. These "ultrahigh" purity solvents will usually ensure that your chromatography is not affected by ionic impurities in the solvent. Currently at DIONEX, we have obtained consistent results using High Purity Solvents manufactured by Burdick and Jackson and Optima Solvents by Fisher Scientific.

6.2.3 DEIONIZED WATER

The deionized water used to prepare eluents should be Type I Reagent Grade Water with a specific resistance of 17.8 megohm-cm or greater. The deionized water should be free of ionized impurities, organics, microorganisms and particulate matter larger than 0.2 μm. Bottled HPLC-Grade Water (with the exception of Burdick & Jackson) should not be used since most bottled water contains an unacceptable level of ionic impurities.

6.3 ELUENT PREPARATION

NOTE

Always degas and store all aqueous eluents in glass or plastic eluent bottles pressurized with nitrogen or helium. Only helium should be used to purge and degas ionic eluents containing solvents, since nitrogen is soluble in solvent containing eluents.

The above precautions, if taken when making eluents, ensure smooth, reproducible ramps, with minimum total change in background conductivity when using sodium carbonate/ bicarbonate, borate or hydroxide eluents with the AS4A-SC columns.

The following table details the use of the above eluent types:

Table 4

Eluent Type Selection

Eluent	Application
Bicarbonate/Carbonate	Isocratic Analysis Only
Borate	Isocratic and Gradient Analysis
Hydroxide	Eluent pH adjustment and Column Cleanup only

6.4 ELUENTS CONTAINING SOLVENTS

When mixing solvents with water remember to mix solvent with water on a volume to volume basis. If a procedure requires an eluent of 90% acetonitrile, prepare the eluent by adding 900 mL of acetonitrile to an eluent reservoir. Then add 100 mL of deionized water to the acetonitrile in the reservoir. Using this procedure to mix solvents with water will ensure that a consistent true volume/volume eluent is obtained. Premixing water with solvent will minimize the possibility of outgassing.

NOTE

When purging or degassing eluents containing solvents, do not purge or degas the eluent excessively since it is possible that a volatile solvent can be "boiled" off from the solution.

Acetonitrile (ACN) hydrolyzes to ammonia and acetate when left exposed to basic solutions. To prevent eluent contamination from acetonitrile hydrolysis, always add acetonitrile to basic aqueous eluents by proportioning the acetonitrile into the basic eluent with the gradient pump. Keep the acetonitrile in a separate eluent bottle containing only acetonitrile and water. Never add the acetonitrile directly to the basic carbonate or borate eluent bottle.

6.5 REGENERANT PREPARATION

The regenerant is 50 mN sulfuric acid. Dilute 100 mL (about 100 g) of 0.50 N sulfuric acid (P/N 037164 or P/N 039601) to 1 L using deionized water. If you are not using the AutoRegen Accessory (P/N 039594), prepare several liters of the regenerant.

For 2mm operation, use the same regenerant flow rate as used in standard 4mm column applications. For many analyses, the regenerant flow rate can be reduced by a factor of 4 times to conserve regenerant. This is especially useful if a pressurized vessel is being used rather than an AutoRegen Accessory Unit.

For a guide to properly adjusting the regenerant flow rate, see Document No. 034449-02, the Installation Instructions and Troubleshooting Guide for the Anion MicroMembrane Suppressor-II, the AMMS-II and Anion MicroMembrane Suppressor, the AMMS (2mm).

6.6 SAMPLE CONCENTRATION

The IonPac AG4A-SC Guard Column can be used for trace anion concentration work primarily in high purity water analysis. The function of AG4A-SC Guard Column in these applications is to strip ions from a measured volume of a relatively clean aqueous sample matrix. This process "concentrates" the desired analyte species onto the AG4A-SC Guard Column, lowering detection limits by 2-5 orders of magnitude. The AG4A-SC is used in lieu of the sample loop. Pump the sample onto the AG4A-SC in the **OPPOSITE** direction of the eluent flow. When using concentration techniques, do not overload the concentrator column by concentrating an excessive amount of sample. Concentrating an excessive amount of sample can result in inaccurate results being obtained. It is possible during the concentration step for the polyvalent anions such as phosphate and sulfate to elute the weakly retained anions such as fluoride and acetate off the concentrator column. For more detailed information on sample concentration techniques for high sensitivity work with IonPac AS4A-SC columns refer to Section 3, Operation, of the Trace Anion Concentrator (TAC-2) Column Installation Instructions and Troubleshooting Guide (Document No. 034467).

CAUTION

IonPac Trace Anion Concentrator (TAC-2) Column (P/N 043101) is designed for 4mm systems. Although the principles of sample concentration are the same for both the AG4A-SC and the TAC-2, the large void volume in the TAC-2 makes it unacceptable for use with 2mm systems.

SECTION 7 - EXAMPLE APPLICATIONS

Before attempting any of the following example applications, take the time to ensure that your system is properly configured. It is very important that applications run on 2mm columns utilize the proper pump configuration (see Section 2, Comparison of 2mm and 4mm Ion Chromatography Systems) and have all system void volumes minimized (see Section 3, 2mm Column Operation Summary).

Ensure that all of the eluents have been made from high purity reagents and deionized water. All water used in the preparation of eluents should be degassed, deionized water. For chemical purity requirements see Section 6.2, Chemicals Required.

In order to guarantee reproducible retention times of analytes when doing gradient chromatography, it is important to install an Anion Trap Column, ATC-1 (4mm) or the ATC (2mm) in the system (see Section 4.2, Installing the Anion Trap Column).

After running synthetic standards to calibrate your system, you may find that real sample matrices foul your columns. For this reason it is always advisable to use a guard column to protect the analytical column. If column performance deteriorates and it is determined that the guard and analytical columns has been fouled, refer to the column cleanup protocols in Section 9, Column Care.

If your sample matrices are relatively low in ionic concentration, you may be able to increase the sensitivity of your system by using sample concentration techniques (see Section 4.3, Sample Concentration).

7.1 PRODUCTION TEST CHROMATOGRAM

7.1.1 DISCUSSION OF METHOD

Isocratic elution of anions on the IonPac AS4A-SC Analytical Column has been optimized utilizing a carbonate/bicarbonate eluent. By using this eluent, mono- and divalent anions can be isocratically separated and quantitated in a single injection. To guarantee that all IonPac AS4A-SC 2mm and 4mm Analytical Columns meet high quality and reproducible performance specification standards, all columns undergo the following production control test.

7.1.2 ELUENT PREPARATION

Eluent: 1.8 mM Carbonate/1.7 mM Bicarbonate

Pipette 10.0 mL of the AS4A Combined Carbonate/Bicarbonate Eluent Concentrate, (100X concentrate = 180 mM Na_2CO_3/170 mM $NaHCO_3$, P/N 039513) into a 1 L volumetric flask. Use degassed, deionized water with a specific resistance of 17.8 megohm-cm or greater to dilute to a final volume of 1,000 mL.

or

The 100X concentrate (180 mM Na_2CO_3/170 mM $NaHCO_3$) can be prepared by thoroughly dissolving 19.078 g of sodium carbonate (MW 106.00 g/mole) plus 14.282 g sodium bicarbonate (MW 84.00 g/mole) in 700 mL degassed, deionized water with a specific resistance of 17.8 megohm-cm or greater in a 1 L volumetric flask. Dilute to a final volume of 1,000 mL.

Make the final eluent by pipetting 10.0 mL of the eluent concentrate, (100X concentrate = 180 mM Na_2CO_3/170 mM $NaHCO_3$) prepared above into a 1 L volumetric flask. Use degassed, deionized water with a specific resistance of 17.8 megohm-cm or greater to dilute to a final volume of 1,000 mL.

7.1.3 GENERAL OPERATING CONDITIONS

Sample Loop Volume:	12.5 µL (2mm), 50 µL (4mm)
Analytical Column:	IonPac AS4A-SC Analytical Column
Eluent:	1.8 mM Na_2CO_3/1.7 mM $NaHCO_3$
Eluent Flow Rate:	0.5 mL/min (2mm), 2.0 mL/min (4mm)
Suppressor:	Anion MicroMembrane Suppressor AMMS (2mm) or AMMS-II (4mm)
Regenerant:	50 mN H_2SO_4
Regenerant Flow Rate:	5 mL/min
Expected Background Conductivity:	15 to 17 µS
Storage Solution:	100 mM NaOH

7.1.4 EXAMPLE 2mm CHROMATOGRAM

1. Fluoride (2.0 mg/L)
2. Chloride (3.0 mg/L)
3. Nitrite (5.0 mg/L)
4. Bromide (10.0 mg/L)
5. Nitrate (10.0 mg/L)
6. Phosphate (15.0 mg/L)
7. Sulfate (15.0 mg/L)

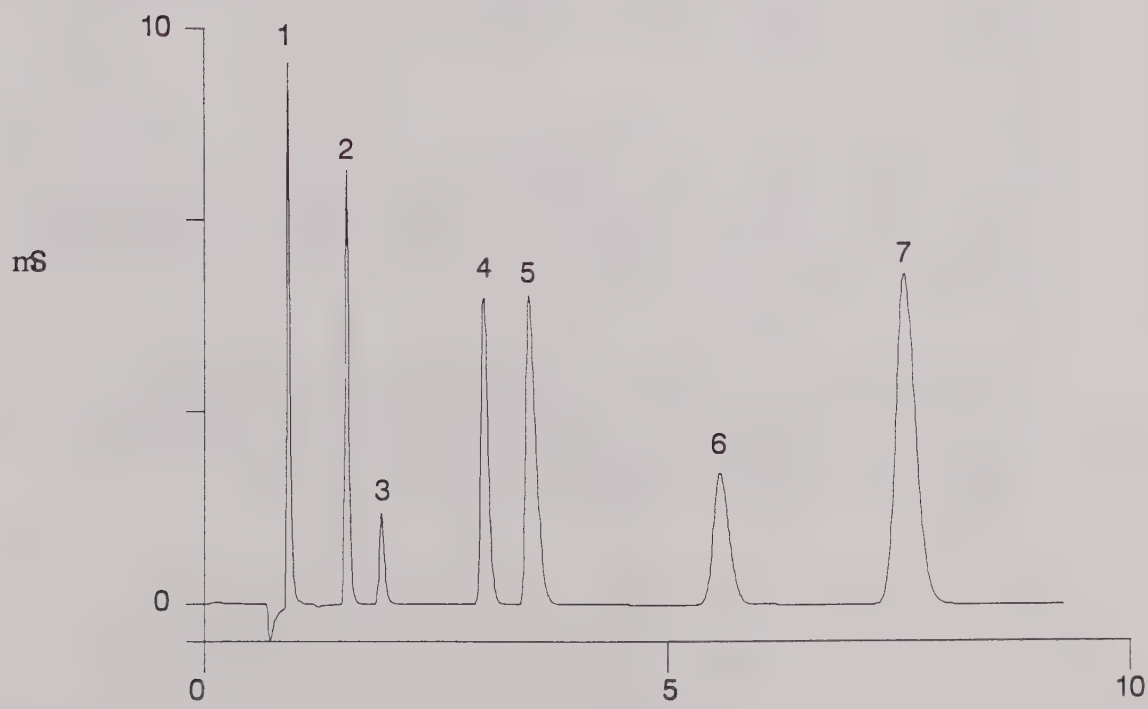


Figure 3

IonPac AS4A-SC
Production Test Chromatogram

7.2 ISOCRATIC ELUTION OF INORGANIC ANIONS PLUS OXALATE

7.2.1 DISCUSSION OF METHOD

Separation and elution of inorganic anions plus oxalate on the IonPac AS4A-SC Analytical Column has been optimized utilizing a carbonate/bicarbonate eluent. By using this eluent, monovalent and divalent anions can be isocratically eluted and quantitated in a single injection. The carbonate/bicarbonate mixture allows the strength of the eluent, and thus the selectivity of the system, to be changed by varying the HCO_3^-/CO_3^{2-} ratio. The suppressor reaction product is carbonic acid (H_2CO_3), which results in a low background conductivity (15 - 17 µS).

7.2.2 ELUENT PREPARATION

Eluent: 1.8 mM Carbonate/1.7 mM Bicarbonate

Pipette 10.0 mL of the AS4A Combined Carbonate/Bicarbonate Eluent Concentrate, (100X concentrate = 180 mM Na_2CO_3/170 mM $NaHCO_3$, P/N 039513) into a 1 L volumetric flask. Use degassed, deionized water with a specific resistance of 17.8 megohm-cm or greater to dilute to a final volume of 1,000 mL.

or

The 100X concentrate (180 mM Na_2CO_3/170 mM $NaHCO_3$) can be prepared by thoroughly dissolving 19.078 g of sodium carbonate (MW 106.00 g/mole) plus 14.282 g sodium bicarbonate (MW 84.00 g/mole) in 700 mL degassed, deionized water with a specific resistance of 17.8 megohm-cm or greater in a 1 L volumetric flask. Dilute to a final volume of 1,000 mL.

Make the final eluent by pipetting 10.0 mL of the eluent concentrate, (100X concentrate = 180 mM Na_2CO_3/170 mM $NaHCO_3$) prepared above into a 1 L volumetric flask. Use degassed, deionized water with a specific resistance of 17.8 megohm-cm or greater to dilute to a final volume of 1,000 mL.

7.2.3 GENERAL OPERATING CONDITIONS

Sample Loop Volume:	5 µL (2mm), 20 µL (4mm)
Guard Column:	IonPac AG4A-SC Guard Column
Analytical Column:	IonPac AS4A-SC Analytical Column
Eluent:	1.8 mM Na_2CO_3/1.7 mM $NaHCO_3$
Eluent Flow Rate:	0.5 mL/min (2mm), 2.0 mL/min (4mm)
Suppressor:	Anion MicroMembrane Suppressor, AMMS (2mm) or AMMS-II (4mm)
Regenerant:	50 mN H_2SO_4
Regenerant Flow Rate:	3-5 mL/min
Expected Background Conductivity:	15 - 20 µS
Concentrator for Trace Level Analysis:	IonPac AG4A-SC 2mm Guard Column (2mm) IonPac TAC-2 (4mm)
Sample Volume for Trace Level Analysis:	4 - 6 mL*
Column Storage Solution:	100 mM NaOH

* The practical anionic loading capacity for any sample matrix must be determined using the procedures outlined in Document No. 034467, the Installation Instructions and Troubleshooting Guide for the IonPac® Trace Anion Concentrator (TAC-2) Column.

7.2.4 EXAMPLE 4mm CHROMATOGRAM

1. Fluoride	(1.0 mg/L)	5. Nitrate	(15.0 mg/L)
2. Chloride	(1.5 mg/L)	6. Phosphate	(20.0 mg/L)
3. Nitrite	(7.5 mg/L)	7. Sulfate	(25.0 mg/L)
4. Bromide	(10.0 mg/L)	8. Oxalate	(25.0 mg/L)

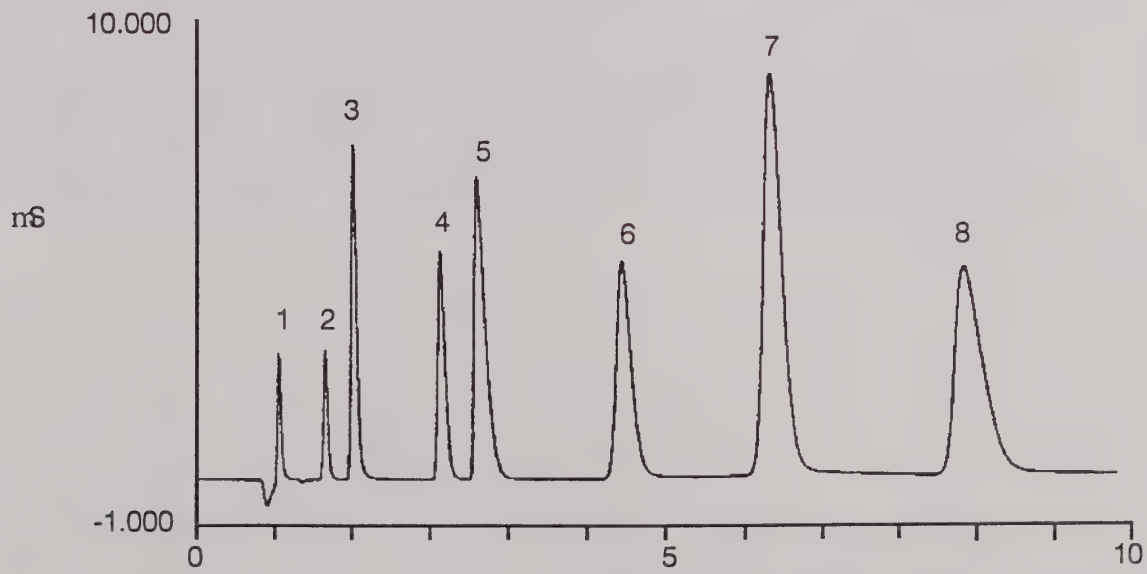


Figure 4

Isocratic Elution of Inorganic Anions plus Oxalate

7.3 ISOCRATIC ELUTION OF WEAKLY RETAINED INORGANIC ANIONS AND ORGANIC ACIDS

7.3.1 DISCUSSION OF METHOD

When using a carbonate/bicarbonate eluent for the isocratic elution of inorganic anions and organic acids, small aliphatic organic acids such as acetate and formate are weakly retained and tend to elute close to the void volume of the column. They often coelute with fluoride during the analysis. If quantification of acetate, fluoride, and formate is required, an eluent with a weak eluting ion must be used. In this case, sodium borate can be used as the eluent since the borate ion ($B_4O_7^{2-}$) is a very weak eluting ion.

7.3.2 ELUENT PREPARATION AND REGENERATION PROGRAM

Eluent: 5 mM Sodium Borate

A. Thoroughly dissolve 1.90 g sodium borate, tetrahydrate (MW 381.42 g/mole) in 700 mL degassed, deionized water with a specific resistance of 17.8 megohm-cm or greater in a 1 L volumetric flask. Dilute to a final volume of 1,000 mL.

Regeneration:

A. During daily operation, it may be necessary to elute the polyvalent anions that concentrate on the column. The best way to remove these anions from the concentrator, guard, and analytical column is to pump 50 mM sodium borate (10X eluent strength) through the system for 10 minutes. The system should be flushed with these high-strength eluents at the end of the day. After cleaning the column, equilibrate it for 20 minutes with the operating eluent. During this cleanup, it is not necessary to disconnect the column from the Anion MicroMembrane Suppressor.

7.3.3 GENERAL OPERATING CONDITIONS

Sample Volume:	5 µL (2mm), 20 µL (4mm)
Guard Column:	IonPac AG4A-SC Guard Column
Analytical Column:	IonPac AS4A-SC Analytical Column
Eluent:	5.0 mM $Na_2B_4O_7$, isocratic
Eluent Flow Rate:	0.5 mL/min (2mm), 2.0 mL/min (4mm)
Suppressor:	Anion MicroMembrane Suppressor, AMMS (2mm) or AMMS-II (4mm)
Regenerant:	50 mN H_2SO_4
Regenerant Flow Rate:	3-5 mL/min
Expected Background Conductivity:	2-4 µS
Concentrator Column for Trace Level Analysis:	IonPac AG4A-SC 2mm Guard Column (2mm) IonPac TAC-2 (4mm)
Sample Volume Required for Trace Level Analysis:	2 - 4 mL*
Column Storage Solution:	100 mM NaOH

* The practical anionic loading capacity for any sample matrix must be determined using the procedures outlined in Document No. 034467, the Installation Instructions and Troubleshooting Guide for the IonPac® Trace Anion Concentrator (TAC-2) Column.

7.3.4 EXAMPLE 4mm CHROMATOGRAM

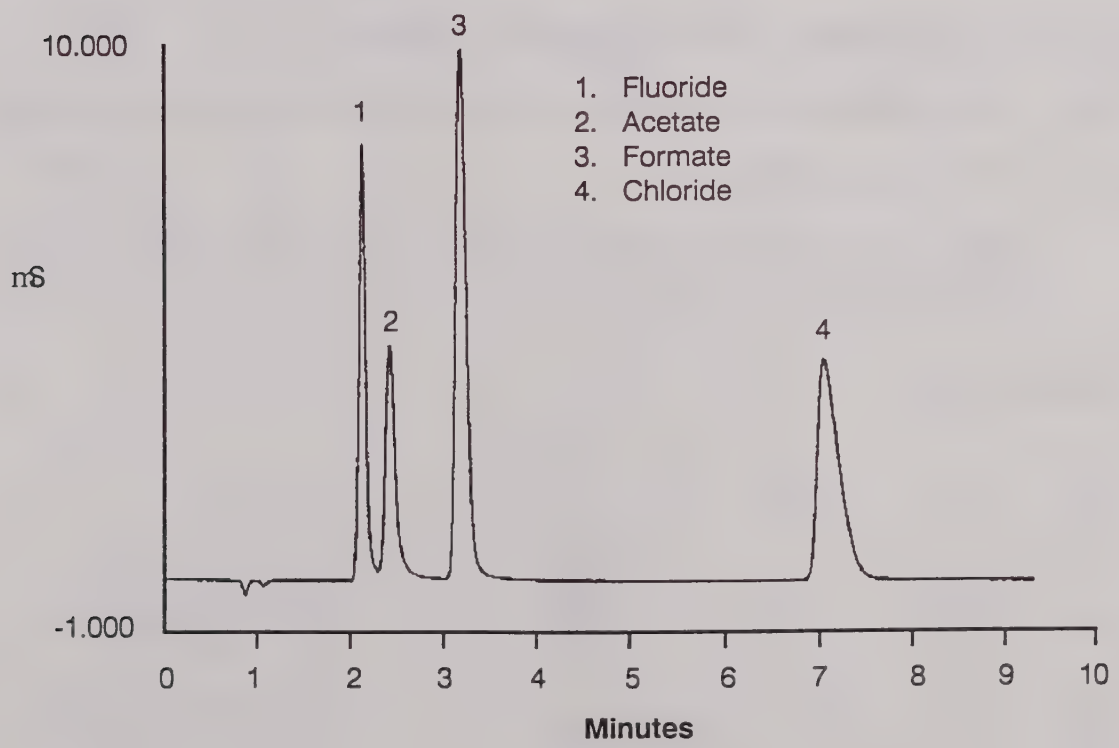


Figure 5

Isocratic Elution of Weakly Retained Inorganic Anions and Organic Acids

7.4 GRADIENT ELUTION OF INORGANIC ANIONS AND ORGANIC ACIDS

7.4.1 DISCUSSION OF METHOD

The determination of small aliphatic organic acids, monovalent and divalent anions in one injection requires a gradient change in the eluent strength during the run. By using this technique it is possible to resolve and quantitate fluoride, formate, and acetate, and at the same time to elute and quantitate sulfate in a 15 minute run time. Sodium borate is converted to the weakly ionized boric acid in the suppressor resulting in a much lower background conductivity and baseline shift from the beginning to the end of the run than is observed with carbonate/bicarbonate eluent systems. The initial 4.9 mM sodium borate eluent is weak enough to elute fluoride beyond the void volume and separate formate and acetate. The final 28 mM sodium borate eluent concentration is capable of eluting phosphate and sulfate. Prior to an injection, the column should be equilibrated with the weak eluent for 10 minutes. During this time, the sample can be loaded onto the IonPac AG4A-SC (2mm) guard column or TAC-2 (4mm) if concentration of the sample is required. If an injection is made before the column has been equilibrated with weak eluent, resolution of fluoride and acetate will suffer and the retention times of all peaks may not be reproducible. Prior to equilibrating the system with the weak eluent, deionized water should be pumped through the entire system for 2 minutes. This step helps to equilibrate the system more quickly with the weak eluent.

7.4.2 ELUENT PREPARATION AND GRADIENT PROGRAM

Eluent 1: Deionized water, with a specific resistance of 17.8 megohm-cm or greater

Eluent 2: 70 mM Sodium Borate

A. Thoroughly dissolve 26.696 g $Na_2B_4O_7 \cdot 10\,H_2O$ (MW 381.42 g/mole) in 700 mL degassed, deionized water with a specific resistance of 17.8 megohm-cm in a 1 L volumetric flask. Dilute to a final volume of 1,000 mL.

Gradient Program

TIME	%E1	%E2	INJECTION VALVE	COMMENT
0.0	100	0	Inject	Start of system rinse.
2.0	100	0	Inject	End of system rinse.
2.1	93	7	Load	System equilibrated with weak eluent. Start sample concentration.
12.0	93	7	Load	Stop sample concentrate.
12.1	93	7	Inject	Inject sample. Start gradient.
20.1	60	40	Inject	Hold gradient.
25.0	60	40	Inject	End analysis.

7.4.3 GENERAL OPERATING CONDITIONS

Sample Volume:	See Concentration Volume Below
Guard Column:	IonPac AG4A-SC Guard Column
Analytical Column:	IonPac AS4A-SC Analytical Column
Eluent #1:	Deionized water (Specific Resistance 17.8 megohm-cm or greater)
Eluent #2:	70 mM $Na_2B_4O_7$
Eluent Flow Rate:	0.5 mL/min (2mm), 2.0 mL/min (4mm)
Suppressor:	Anion MicroMembrane Suppressor, AMMS (2mm) or AMMS-II (4mm)
Regenerant:	50 mN H_2SO_4
Regenerant Flow Rate:	10-15 mL/min
Expected Background Conductivity:	
Weak Eluent (4.9 mM $Na_2B_4O_7$):	2 - 4 µS
Strong Eluent (28.0 mM $Na_2B_4O_7$):	10 - 12 µS
Anion Trap Column:	ATC (2mm) or ATC-1 (4mm)
Concentrator Column for Trace Level Analysis:	IonPac AG4A-SC 2mm Guard Column (2mm) IonPac TAC-2 (4mm)
Sample Volume for Trace Level Analysis:	3 - 5 mL*

* The practical anionic loading capacity for any sample matrix must be determined using the procedures outlined in Document No. 034467, the Installation Instructions and Troubleshooting Guide for the IonPac® Trace Anion Concentrator (TAC-2) Column.

7.4.4 EXAMPLE 2mm CHROMATOGRAM

1. Fluoride	(3 µg/L)	4. Chloride	(8 µg/L)	7. Nitrate	(17 µg/L)
2. Acetate	(30 µg/L)	5. Nitrite	(5 µg/L)	8. Phosphate	(17 µg/L)
3. Formate	(7 µg/L)	6. Bromide	(8 µg/L)	9. Sulfate	(17 µg/L)

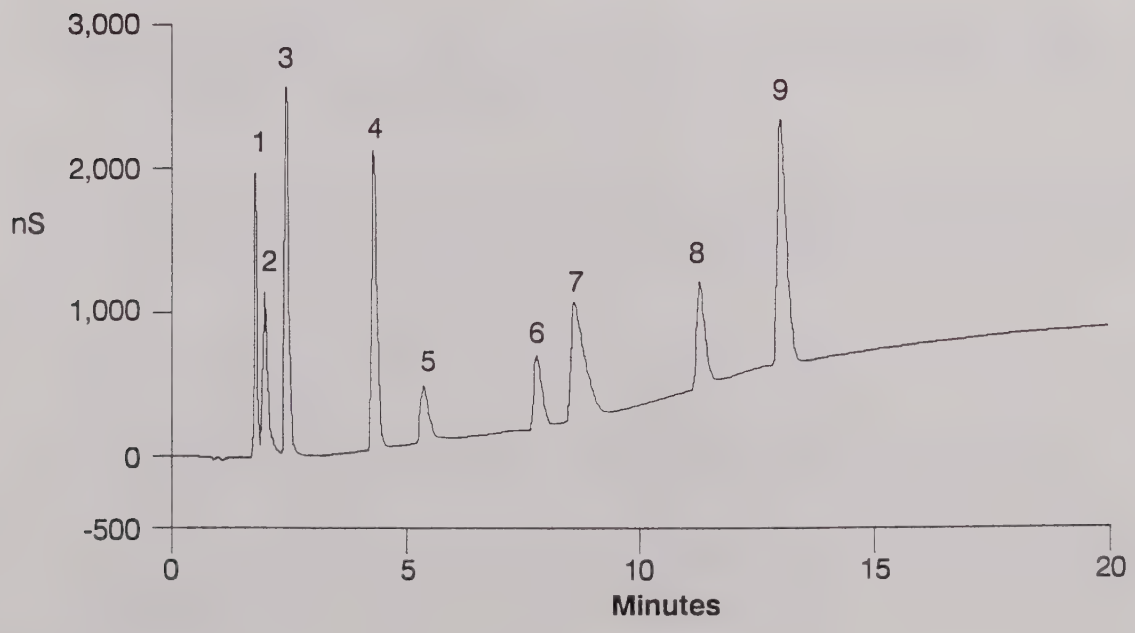


Figure 6

Gradient Elution of Inorganic Anions and Organic Acids

SECTION 8 - TROUBLESHOOTING GUIDE

The purpose of the Troubleshooting Guide is to help you solve operating problems that may arise while using IonPac AS4A-SC columns. For more information on problems that originate with the Ion Chromatograph (IC) or the Anion MicroMembrane Suppressor, refer to the Troubleshooting Guide in the appropriate operator's manual. If you cannot solve the problem on your own, call the DIONEX Regional Office nearest you (see Section 12, DIONEX Regional Offices).

8.1 HIGH BACKPRESSURE

8.1.1 FINDING THE SOURCE OF HIGH SYSTEM PRESSURE

Total system pressure when using the IonPac AG4A-SC (2mm) Guard and AS4A-SC (2mm) Analytical Columns at 0.50 mL/min should less than 1,500 psi when using the eluent used to generate the test chromatogram. Total system pressure when using the IonPac AG4A-SC (4mm) Guard and AS4A-SC (4mm) Analytical Columns at 2.0 mL/min should also be less than 1,500 psi when using the eluent used to generate the test chromatogram. Refer to Section 6.1.1, Solvents, to see how solvent concentration can affect the column operating pressure. If the system pressure is higher than 1,500 psi, it is advisable to find out what is causing the high system pressure. The system should be used with a High-Pressure In-Line Filter (P/N 035331) for the eluents which is positioned between the Advanced Gradient Pump (AGP-1) pressure transducer and the injection valve. Make sure you have one in place and that it is not contaminated.

A. Make sure that the pump is set to the correct eluent flow rate. Higher than recommended eluent flow rates will cause higher pressure. Measure the pump flow rate if necessary with a stop watch and graduated cylinder.

B. Find out what part of the system is causing the high pressure. It could be a piece of tubing that has plugged or whose walls are collapsed, an injection valve with a plugged port, a column with particulates plugging the bed support, a plugged High-Pressure In-Line Filter, the Anion MicroMembrane Suppressor or the detector cell.

   To find out which part of the chromatographic system is causing the problem, disconnect the pump eluent line from the injection valve and turn the pump on. Watch the pressure; it should not exceed 50 psi. Continue adding the system's components (injection valve, column(s), Anion MicroMembrane Suppressor and detector) one by one, while watching the system pressure. The pressure should increase up to a maximum of 1,500 psi when the column(s) are connected. The Anion MicroMembrane Suppressor may add up to 100 psi. No other components should add more than 100 psi of pressure. Refer to the appropriate manual for cleanup or replacement of the problem component.

8.1.2 REPLACING COLUMN BED SUPPORT ASSEMBLIES

If the column inlet bed support is determined to be the cause of the high backpressure, it should be replaced. To change the inlet bed support assembly, refer to the following instructions, using one of the two spare inlet bed support assemblies included in the Ship Kit.

A. Disconnect the column from the system.

B. Using two open end wrenches, carefully unscrew the inlet (top) column fitting.

C. Turn the end fitting over and tap it against a benchtop or other hard, flat surface to remove the bed support and seal assembly. If the bed support must be pried out of the end fitting, use a sharp pointed object such as a pair of tweezers, but be careful that you **DO NOT SCRATCH THE WALLS OF THE END FITTING.** Discard the old bed support assembly.

D. Place a new bed support assembly into the end fitting. Make sure that the end of the column tube is clean and free of any particulate matter so that it will properly seal against the bed support assembly. Use the end of the column to carefully start the bed support assembly into the end fitting.

	IonPac AS4A-SC	
	2mm Columns (P/N)	4mm Columns (P/N)
Analytical Column	043125	043174
Guard Column	043126	043175
Bed Support Assembly	044689	042955
End Fitting	043278	042367

CAUTION

If the column tube end is not clean when inserted into the end fitting, particulate matter may obstruct a proper seal between the end of the column tube and the bed support assembly. If this is the case, additional tightening may not seal the column but instead damage the column tube or the end fitting.

E. Screw the end fitting back onto the column. Tighten it fingertight, then an additional 1/4 turn (25 in x lb). Tighten further only if leaks are observed.

F. Reconnect the column to the system and resume operation.

NOTE

Replace the outlet bed support ONLY if high pressure persists after replacement of the inlet fitting.

8.2 HIGH BACKGROUND OR NOISE

In a properly working system, the background conductivity level for the standard eluent system is shown below:

ELUENT	EXPECTED BACKGROUND CONDUCTIVITY
1.8 mM Na_2CO_3/1.7 mM $NaHCO_3$	14 - 18 µS
4.9 mM $Na_2B_4O_7$	2 - 4 µS
28 mM $Na_2B_4O_7$	12 - 14 µS

The background conductivity typically increases between 1 and 10 µS when running a gradient as described in Section 7.4, Gradient Elution of Inorganic Anions and Organic Acids.

8.2.1 PREPARATION OF ELUENTS

A. Make sure that the eluents and the regenerant are made correctly.

B. Make sure that the eluents are made from chemicals with the recommended purity.

C. Make sure that the deionized water used to prepare the reagents has a specific resistance of 17.8 megohm-cm or greater.

8.2.2 A CONTAMINATED ANION TRAP COLUMN, THE ATC (2mm) or THE ATC-1 (4mm)

When doing gradient analysis, has the Anion Trap Column, the ATC (2mm) or the ATC-1 (4mm) been installed correctly? If it has not, install one as directed in Section 4.2, Installing the Anion Trap Column, and watch the background conductivity. If the background conductivity is now low, this means that the ATC is trapping contaminants from the eluent. The eluents probably have too many impurities (see items 1 - 3 above).

If the ATC is already installed, remove it. Is the background conductivity still high? If the background conductivity decreases, the ATC is the source of the high background conductivity.

A. Disconnect either the ATC (2mm) or the ATC-1 (4mm) from the injection valve and direct the outlet to waste.

B. Flush the ATC with 200 mL of 70 mM $Na_2B_4O_7$. Use a flow rate of 0.5 mL/min on a 2mm system or a flow rate of 2.0 mL/min on a 4mm system.

C. Equilibrate the ATC with the strongest eluent used during the gradient run. Use a flow rate of 0.5 mL/min on a 2mm system or a flow rate of 2.0 mL/min on a 4mm system.

D. If the problem persists, replace the ATC.

8.2.3 A CONTAMINATED GUARD OR ANALYTICAL COLUMN

Remove the IonPac AG4A-SC Guard and AS4A-SC Analytical Columns from the system. Is the background conductivity still high? If the column is the cause of the high background conductivity, clean the column as instructed in Section 9.4, Column Cleanup.

8.2.4 CONTAMINATED HARDWARE

To eliminate the hardware as the source of the high background conductivity, bypass the Anion MicroMembrane Suppressor and pump deionized water with a specific resistance of 17.8 megohm-cm or greater through the system. The background conductivity should be less than 2 µS. If it is not, check the detector/conductivity cell calibration by injecting deionized water directly into it. See the appropriate manual for details.

8.2.5 A CONTAMINATED ANION MICROMEMBRANE SUPPRESSOR

If the above items have been checked and the problem persists, the Anion MicroMembrane Suppressor, AMMS (2mm) or the AMMS-II is probably causing the problem.

A. Check the regenerant flow rate at the REGEN OUT port of the AMMS. For the example isocratic applications, this flow rate should be 3 - 5 mL/min.

B. Check the eluent flow rate. In general, the eluent flow rate for 2mm applications should be 0.50 mL/min and for 4mm applications, it should be 2.0 mL/min. Refer to the Anion MicroMembrane Suppressor Installation Instructions and Troubleshooting Guide (Document No. 034449-02) for assistance in determining that the eluent is within suppressible limits.

C. Prepare fresh regenerant solution. Bypass the Anion AutoRegen Regenerant Cartridge (if you are using the AutoRegen Accessory). If the background conductivity is high, you probably need to clean or replace your Anion MicroMembrane Suppressor. Refer to the Anion MicroMembrane Suppressor Installation Instructions and Troubleshooting Guide (Document No. 034449-02) for assistance.

D. If you are using an AutoRegen Accessory, connect the freshly prepared regenerant to the Anion AutoRegen Regenerant Cartridge. Pump approximately 200 mL of regenerant through the Anion AutoRegen Regenerant Cartridge to waste before recycling the regenerant back to the regenerant reservoir. If the background conductivity is now high, you probably need to replace the Anion AutoRegen

Regenerant Cartridge (P/N 039564). Refer to the AutoRegen Regenerant Cartridge Refill Installation Instructions and Troubleshooting Guide (Document No. 032852) for assistance.

8.3 POOR PEAK RESOLUTION

Poor peak resolution can be due any or all of the following factors.

8.3.1 LOSS OF COLUMN EFFICIENCY

A. Check to see if headspace has developed in the guard or analytical column (e.g., due to improper use of the column such as submitting it to high pressures). Remove the column's top end fitting (see Section 8.1.2, Replacing Column Bed Support Assemblies). If the resin does not fill the column body all the way to the top, it means that the resin bed has collapsed, creating a headspace. The column must be replaced.

B. Extra-column effects can result in sample band dispersion, making the peaks' elution less efficient. Make sure you are using PEEK tubing with an ID of no greater than 0.010" to make all eluent liquid line connections between the injection valve and the detector cell inlet, and that the tubing lengths are as short as possible. Check for leaks.

8.3.2 POOR RESOLUTION DUE TO SHORTENED RETENTION TIMES

Even with adequate system and column efficiency, resolution of peaks will be compromised if analytes elute too fast.

A. Check to see if the eluent flow rate is not faster than the flow rate specified by the analytical protocol. Measure the eluent flow rate after the column using a stopwatch and graduated cylinder.

B. Check to see if the eluent compositions and concentrations are correct. An eluent that is too strong will cause the peaks to elute faster. Prepare fresh eluent. If you are using a gradient pump to proportion the eluent, components from two or three different eluent reservoirs, the resulting eluent composition may not be accurate enough for the application. Use one reservoir containing the correct eluent composition to see if this is the problem. This may be a problem when one of the proportioned eluents is less than 5%.

C. Column contamination can lead to a loss of column capacity because all of the anion exchange sites will no longer be available for the sample ions. Polyvalent anions might be concentrating on the column. Refer to Section 9.4, Column Cleanup, for recommended column cleanup procedures.

   Possible sources of column contamination are impurities in chemicals and in the deionized water being used. Be especially careful to make sure that the

recommended chemicals are used. The deionized water should have a specific resistance of at least 17.8 megohm-cm or better.

D. Diluting the eluent will improve peak resolution, but will also increase the analytes' retention times. If a 10% dilution of the eluent is not sufficient to obtain the desired peak resolution, or if the resulting increase in retention times is unacceptable, clean the column (see Section 9.4, Column Cleanup).

After cleaning the column, reinstall it in the system and let it equilibrate with eluent for about 30 minutes. The column is equilibrated when consecutive injections of the standard give reproducible retention times. The original column capacity should be restored by this treatment, since the contaminants should be eluted from the column. If you need assistance in solving resolution problems, contact the nearest DIONEX Regional Office (see Section 12, DIONEX Regional Offices)

8.3.3 LOSS OF FRONT END RESOLUTION

If poor resolutions and efficiencies are observed for the very early eluting peaks near the system void volume compared to the later eluting peaks, check the following:

A. Improper eluent concentration may be the problem. Remake the eluent as required for your application. Ensure that the water and chemicals used are of the required purity.

B. Column overloading may be the problem. Reduce the amount of sample ions being injected onto the analytical column by either diluting the sample or injecting a smaller volume onto the column.

C. Sluggish operation of the injection valve may be the problem. Check the air pressure and make sure there are no gas leaks or partially plugged port faces. Refer to the valve manual for instructions.

D. Improperly swept out volumes anywhere in the system prior to the guard and analytical columns may be the problem. Swap components, one at a time, in the system prior to the analytical column and test for front-end resolution after every system change.

8.4 SPURIOUS PEAKS

A. If the samples contain an appreciable level of polyvalent ions and the column is used with a weak eluent system, polyvalent anions may contaminate the analytical column. The retention times for the analytes will then decrease and spurious, inefficient (broad) peaks can show up at unexpected times. Clean the column as indicated in Section 9.4, Column Cleanup.

B. If you need assistance in determining the best way to clean strongly retained solutes in your specific sample matrix from the IonPac AS4A-SC columns, contact the nearest DIONEX Regional Office (see Section 12, DIONEX Regional Offices).

C. When an injection valve is actuated, the possibility of creating a baseline disturbance exists. This baseline upset can show up as a peak of varying size and shape. It will happen when the injection valve needs to be cleaned or retorqued (see valve manual). Check to see that there are no restrictions in the tubing connected to the valve. Also check the valve port faces for blockage and replace them if necessary. Refer to the Valve Manual for troubleshooting and service procedures. Small baseline disturbances at the beginning or at the end of the chromatogram can be overlooked as long as they do not interfere with the quantification of the peaks of interest.

If cleaning and retorquing the valve does not help, replace the valve. Use a DIONEX High Pressure Injection Valve (P/N 037142) or a DIONEX High Pressure Inert Valve (P/N 037143) as required.

For DX-300 systems equipped with a Rheodyne Microinjection Valve, Model 9126 (DIONEX P/N 044697), consult the accompanying manual for service instructions. See Section 5.4, Injection Loop, for injection valve and loop requirements for 2mm operation.

SECTION 9 - COLUMN CARE

9.1 RECOMMENDED OPERATION PRESSURES

Operating a column above its recommended pressure limit can cause irreversible loss of column performance. The maximum recommended operating pressure for IonPac AS4A-SC columns is 4,000 psi.

9.2 COLUMN START-UP

The column is shipped in 100 mM NaOH storage solution.

Prepare the eluent shown on the test chromatogram, install the column in the chromatography module and test the column performance under the conditions described in the test chromatogram. Continue making injections of the test standard until consecutive injections of the standard give reproducible retention times. Equilibration is complete when consecutive injections of the standard give reproducible retention times.

9.3 COLUMN STORAGE

For short-term storage, the strongest eluent in use can be used as the storage solution. For long-term storage, 100 mM NaOH should be used as the storage solution. Flush the column for a minimum of 10 minutes with the storage solution. Cap both ends securely, using the plugs supplied with the column.

9.4 COLUMN CLEANUP

The following column cleanup protocols have been divided into three general isocratic protocols to remove acid-soluble, base-soluble or organic contaminants. They can be combined into one gradient protocol if desired but the following precautions should be observed.

Always ensure that the cleanup protocol used does not switch between eluents which may create high pressure eluent interface bands in the column. High pressure bands can disrupt the uniformity of the packing of the column bed and irreversibly damage the performance of the column. High pressure bands in the column can be created by pumping successive eluents through the column that are not miscible, that have eluent components in one eluent that will precipitate out in the other eluent or by using an acid eluent followed by a base eluent with may create a neutralization pressure band. The precipitation of the salts in solvents during column rinses can result in very high pressure bands. High viscosity mixing bands can be created between two eluents having solvents with a very high energy of mixing.

When in doubt, always include short column rinse steps to reduce the solvent content of the eluent to 5% levels and the ionic strength of the eluent to 50 mM levels to avoid creating high pressure bands in the column that may disrupt the uniformity of the column packing.

9.4.1 BASE-SOLUBLE CONTAMINANTS

A. Prepare a 500 mL solution of 500 mM NaOH in deionized water having a specific resistance of 17.8 megohm-cm or better.

B. Disconnect the AMMS (2mm) or AMMS-II (4mm) from the IonPac AS4A-SC Analytical Column. If your system is configured with both a guard column and an analytical column, reverse the order of the guard and analytical column in the eluent flow path. Double check that the eluent flows in the direction designated on each of the column labels. Direct the effluent from the outlet line of the AS4A-SC Guard Column to a separate waste container.

CAUTION

When cleaning an analytical column and a guard column in series, ensure that the guard column is placed after the analytical column in the eluent flow path. Contaminants that have accumulated on the guard column can be eluted onto the analytical column and irreversibly damage it. If in doubt, clean each column separately.

C. Set the pump flow rate to 0.50 mL/min (2mm systems) or 2.0 mL/min (4mm systems).

D. If your eluent contains a solvent that is not compatible with 500 mM NaOH, rinse the column for 15 minutes with deionized water before pumping the 500 mM NaOH over the column.

E. Pump 500 mM NaOH solution through the column for 30-60 minutes

F. If your eluent contains a solvent that is not compatible with 500 mM NaOH, rinse the column for 15 minutes with deionized water before pumping eluent over the column.

G. Reconnect the AMMS (2mm) or AMMS-II (4mm) to the AS4A-SC Analytical Column and place the guard column in line between the injection valve and the analytical column if your system was originally configured with a guard column.

H. Equilibrate the column(s) with eluent before resuming normal operation.

NOTE

It may not be necessary to use 500 mM sodium hydroxide in the above cleanup procedure. You may find it more beneficial, depending on you sample matrix, to use a 10X concentrate of your sodium carbonate/bicarbonate or sodium borate eluent. Note that the maximum solubility of sodium borate is 300 mM.

9.4.2 ACID-SOLUBLE CONTAMINANTS

A. Prepare a 500 mL solution of 1 M HCl in deionized water having a specific resistance of 17.8 megohm-cm or better.

B. Disconnect the AMMS (2mm) or AMMS-II (4mm) from the IonPac AS4A-SC Analytical Column. If your system is configured with both a guard column and an analytical column, reverse the order of the guard and analytical column in the eluent flow path. Double check that the eluent flows in the direction designated on each of the column labels. Direct the effluent from the outlet line of the AS4A-SC Guard Column to a separate waste container.

CAUTION

When cleaning an analytical column and a guard column in series, ensure that the guard column is placed after the analytical column in the eluent flow path. Contaminants that have accumulated on the guard column can be eluted onto the analytical column and irreversibly damage it. If in doubt, clean each column separately.

C. Set the pump flow rate to 0.50 mL/min (2mm systems) or 2.0 mL/min (4mm systems).

D. Rinse the column for 15 minutes with deionized water before pumping the 1 M HCl over the column.

E. Pump 1 M HCl solution through the column for 30-60 minutes.

NOTE

Nitric acid should not be used instead of hydrochloric acid since nitric acid will not efficiently remove iron contaminants.

F. Rinse the column for 15 minutes with deionized water before pumping the 100 mM NaOH over the column.

G. Pump 100 mM NaOH through the column for 15 minutes.

H. If your eluent contains a solvent that is not compatible with 100 mM NaOH, rinse the column for 15 minutes with deionized water before pumping eluent over the column.

I. Reconnect the AMMS (2mm) or AMMS-II (4mm) to the AS4A-SC Analytical Column and place the guard column in line between the injection valve and the analytical column if your system was originally configured with a guard column.

J. Equilibrate the column(s) with eluent before resuming normal operation.

9.4.3 ORGANIC CONTAMINANTS

A. Prepare a 500 mL solution of 90% acetonitrile in deionized water having a specific resistance of 17.8 megohm-cm or better.

B. Disconnect the AMMS (2mm) or AMMS-II (4mm) from the IonPac AS4A-SC Analytical Column. If your system is configured with both a guard column and an analytical column, reverse the order of the guard and analytical column in the eluent flow path. Double check that the eluent flows in the direction designated on each of the column labels. Direct the effluent from the outlet line of the AS4A-SC Guard Column to a separate waste container.

CAUTION

When cleaning an analytical column and a guard column in series, ensure that the guard column is placed after the analytical column in the eluent flow path. Contaminants that have accumulated on the guard column can be eluted onto the analytical column and irreversibly damage it. If in doubt, clean each column separately.

C. Set the pump flow rate to 0.50 mL/min (2mm systems) or 2.0 mL/min (4mm systems).

D. If your eluent contains a solvent that is not compatible with 90% acetonitrile, rinse the column for 15 minutes with deionized water before pumping the 90% acetonitrile over the column.

E. Pump a 90% acetonitrile solution through the column for 30-60 minutes.

F. If your eluent contains a solvent that is not compatible with 90% acetonitrile, rinse the column for 15 minutes with deionized water before pumping eluent over the column.

G. Reconnect the AMMS (2mm) or AMMS-II (4mm) to the AS4A-SC Analytical Column and place the guard column in line between the injection valve and the analytical column if your system was originally configured with a guard column.

H. Equilibrate the column(s) with eluent before resuming normal operation.

NOTE

It is not necessary to use 90% acetonitrile in the above cleanup procedure. You may find it more beneficial, depending on you sample matrix, to use a different organic solvent such as methanol or isopropanol.

SECTION 10 - INSTALLATION OF DIONEX LIQUID LINE FITTINGS

10.1 LIQUID LINE CONVERSION BETWEEN 10-32 AND 1/4-28 FITTINGS

During the course of installing and using the IonPac AS4A-SC or AG4A-SC, it may be necessary to obtain a transition liquid line for use between the 10-32 eluent ports on the IonPac AS4A-SC or AG4A-SC and a component that requires a 1/4-28 liquid line fitting. PEEK tubing, ferrules and bolts should be used for all liquid line connections between 10-32 ports. A Tefzel transition liquid line with a PEEK 10-32 fitting on one end and a 1/4-28 ThermoFlare fitting on the other end can be used in applications with or without solvent where the tubing is not subject to pressures over 2,000 psi. The following Tefzel transition liquid lines can be obtained from DIONEX:

P/N	Description
043780	Tefzel liquid line, 0.007" ID x 12" long with one 10-32 and one 1/4-28 fitting
043781	Tefzel liquid line, 0.012" ID x 12" long with one 10-32 and one 1/4-28 fitting

Reposition the 10-32 threaded fitting bolt (P/N 043275) and a double-cone ferrule (P/N 043276) on the line to make the length of the line between components in the eluent flow path as short as possible.

10.2 ASSEMBLY AND INSTALLATION OF 10-32 PEEK FERRULE/BOLT FITTINGS

The DIONEX Ferrule Fitting System consists of a length of 1/16" OD tubing, a 10-32 threaded tapered port, a HPLC 10-32 threaded fitting bolt (P/N 043275) and a double-cone ferrule (P/N 043276). The fitting is intended to be installed into a 10-32 threaded, tapered port as shown in Figure 7, 10-32 PEEK Ferrule Fitting System, below. The bolt and ferrule are fabricated from high-strength PEEK plastic which conforms to a relatively large range of port geometries but works most reliably in the DIONEX 10-32 PEEK ports. The DIONEX Ferrule Fitting System can be used on any semi-rigid tubing such as Tefzel or rigid tubing such as PEEK or stainless steel tubing with an outside diameter of 0.062". Although stainless steel tubing can be used, it should be avoided because it can damage PEEK ports if the bolt/ferrule assemblies are not properly made and because it will introduce metals into the analytical flow path. As is true for all of the liquid lines in the eluent flow path, an internal diameter of 0.012" or less is required (0.010" or 0.005" ID PEEK tubing should be used on 10-32 columns and components).

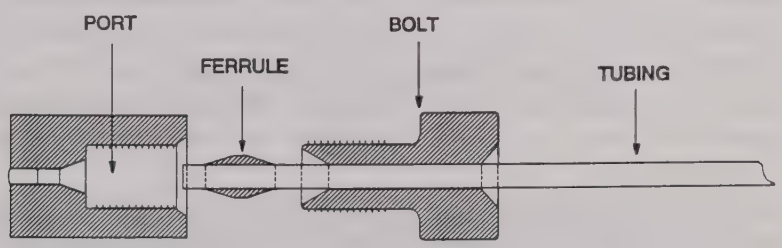


Figure 7

10-32 PEEK Ferrule Fitting System

The following procedure is used to install the 10-32 PEEK bolt and ferrule fittings on liquid lines. For the most reliable performance, DIONEX recommends the use of PEEK tubing whenever liquid lines with 10-32 fittings are required. Whenever a transition liquid line to a component with a 1/4-28 fitting is required, a Tefzel transition liquid line with a PEEK 10-32 ferrule/bolt fitting on one end and a 1/4-28 ThermoFlare fitting on the other end can be used.

A. The PEEK tubing provided by DIONEX has a 0.062" OD which is important so that the ferrule fits snugly on the tubing and thus makes a good seal. In situations where Tefzel tubing will be used, the PEEK bolt and ferrule do not easily slide onto Tefzel tubing when making a transition liquid line, a short section of the Tefzel tubing should be stretched slightly to reduce its diameter (see Figure 5 for details on assembling a Tefzel transition liquid line with a PEEK bolt and ferrule).

B. Slide the end of the tubing through the hex-end of the PEEK bolt and then through the ferrule. The ferrule is symmetrical and can be pushed onto the tubing through either end.

C. Pull the tubing through the 10-32 PEEK bolt and the ferrule until the ferrule fits snugly on a section of the PEEK tubing or if Tefzel tubing is used, pull the ferrule onto the unstretched section of Tefzel tubing.

D. Cut the tubing off at least 1/8" past the end of the ferrule. Make sure that the end is cut off carefully at a right angle to the length of the tubing and that there are no nicks or burrs on the end of the tubing. Being careful while making liquid line fittings will reduce dead volumes and band broadening. This is important for maximum system performance.

E. Place the tubing with the ferrule and the 10-32 PEEK bolt into the 10-32 port and push the tubing through the bolt until it fits snugly against the bottom of the port. Making sure that there is no gap between the end of the tubing and the bottom of the port will ensure low dead volumes and minimal band broadening. This is important for maximum system performance.

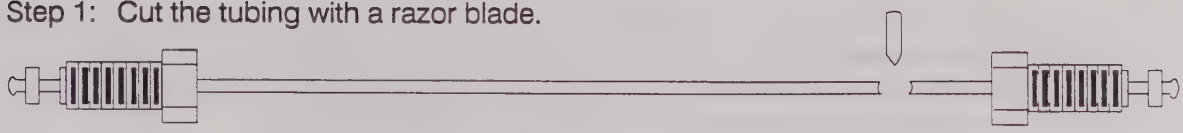
CAUTION

Tighten the 10-32 PEEK bolt by hand until it is fingertight. As the bolt is tightened further, the ferrule will compress tightly around the tubing. In the case of Tefzel tubing, the compression of the ferrule will also compress the semi-rigid Tefzel tubing. Overtightening the bolts can reduce the ID of Tefzel tubing until flow through the tubing is completely restricted. Severe overtightening of the bolt in all cases can damage the mating surfaces of the 10-32 port. Fingertight torquing of the liquid line bolts provides leak free operation up to 3,000 psi.

F. For the best performance, end fittings should be mated to ports. Once a ferrule has been compressed inside a particular 10-32 port, it can be removed and reinstalled in the same port without sacrificing performance. If a liquid line needs to be routed to a new port, a new ferrule should be mounted on the end of the line and compressed in the new port to form a mated ferrule/port pair. This ensures the best sealing properties.

Tefzel Tubing with two 1/4-28 ThermoFlare/bolt assemblies

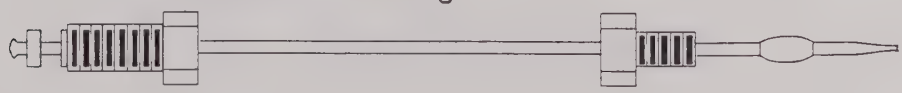
Step 1: Cut the tubing with a razor blade.



Step 2: Stretch the tubing only if it does not slip through the ferrule.

Step 3: Cut the tubing at the smallest diameter in the stretched region.

Step 4: Slip a 10-32 PEEK bolt and ferrule on the stretched tubing and then pull them PAST the stretched section of tubing.



Step 5: Cut the tubing perpendicular to its axis and approximately 1/8" from ferrule. Remove ALL of the stretched tubing!

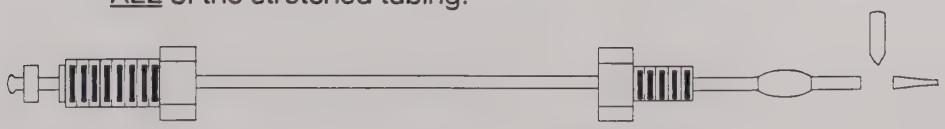


Figure 8

Tighten the 10-32 ferrule/bolt assembly fingertight ONLY.
Overtightening will constrict the Tefzel tubing

10.3 ASSEMBLY AND INSTALLATION OF THERMOFLARE FITTINGS (ON TEFZEL TUBING ONLY)

If you already have a short connecting liquid line with ThermoFlare fittings on both ends for use between components with 1/4-28 ThermoFlare end fittings, you may choose to cut off one of the 1/4-28 ThermoFlare end fittings with a razor blade and replace it with a 10-32 PEEK ferrule/bolt assembly, as described in Section 7.2, Assembly and Installation of 10-32 PEEK Ferrule/Bolt Fittings .

If you choose to assemble new Tefzel lines with 1/4-28 end fittings, the sealing surface of the 1/4-28 ThermoFlare fitting is made by first heating and then flaring the end of the tubing with a special flaring tool (120 VAC version, P/N 037196 or 230 VAC version, P/N 037197). Complete instructions for using the tool are in Document No. 032843.

If you prefer not to buy a flaring tool, liquid lines designed for use in the eluent flow path with factory-made ThermoFlares are available from DIONEX in the following lengths:

P/N	Description
039335	Tefzel line, 0.012" ID x 4" long with two 1/4-28 fittings
039336	Tefzel line, 0.012" ID x 8" long with two 1/4-28 fittings
039337	Tefzel line, 0.012" ID x 12" long with two 1/4-28 fittings
039338	Tefzel line, 0.012" ID x 24" long with two 1/4-28 fittings

Column Accessories

044689	Bed Support Assembly, 2mm Columns with 10-32 Columns
042955	Bed Support Assembly, 4mm Columns with 10-32 Columns
043278	End Fitting, 2mm 10-32 Columns
042367	End Fitting, 4mm 10-32 Columns
043780	Tefzel line, 0.007" ID x 12" long with one 10-32 and one 1/4-28 fitting
043781	Tefzel line, 0.012" ID x 12" long with one 10-32 and one 1/4-28 fitting
039335	Tefzel line, 0.012" ID x 4" long with two 1/4-28 fittings
039336	Tefzel line, 0.012" ID x 8" long with two 1/4-28 fittings
039337	Tefzel line, 0.012" ID x 12" long with two 1/4-28 fittings
039338	Tefzel line, 0.012" ID x 24" long with two 1/4-28 fittings
042690	PEEK Tubing, 0.010" ID x 0.062" OD
044221	PEEK Tubing, 0.005" ID x 0.062" OD
043275	Bolt, Double Cone Ferrule Fitting, 10-32 (PEEK)
043276	Double Cone Ferrule, 10-32 (PEEK), ea
043225	Double Cone Ferrule, 10-32 (PEEK), pkg of 10
042772	Plug, Ferrule Fitting, 10-32 (PEEK), ea
042806	Union, Black PEEK 10-32 ferrule to 1/4-28 ThermoFlare Tefzel Line
039296	Union, 1/4-28 to 1/4-28, 0.020" ID
039056	Union, 1/4-28 to 1/4-28, 0.062" ID
037196	ThermoFlare Tool (115 V)
037197	ThermoFlare Tool (230 V)
041620	ThermoFlare Tubing Kit
039302	ThermoFlare Washers
044697	Rheodyne Microinjection Valve, Model No. 9126

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READER'S COMMENTS FORM

IONPAC AS4A-SC / IONPAC AG4A-SC COLUMNS
INSTALLATION INSTRUCTIONS AND TROUBLESHOOTING GUIDE

Your opinions and comments help us produce better manuals. Please answer the following questions by circling a number from 1 to 4.

Is the manual easy to understand? Yes ← 4 3 2 1 → No

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_____

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_____

Is the manual accurate? Yes ← 4 3 2 1 → No

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Use the space below to suggest changes that you feel would improve the manual. Please use page and section references when possible. Attach extra sheets if necessary.

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IONPAC AS4A-SC 4mm (10-32) ANALYTICAL COLUMN (P/N 043174)
TEST CHROMATOGRAM

This chromatogram was obtained during a quality control test. Please note that test fixtures were used, so slight variations from the test chromatogram may occur on your instrument. Eluent batch and laboratory climate can also affect chromatographic performance.

Eluent: 1.8 mM Na_2CO_3/1.7 mM $NaHCO_3$ **Flow Rate:** 2.0 mL/min

Detection: Suppressed Conductivity at 30 µSFS

Standard: 25 µL of:

1.	Fluoride	2.0 mg/L	5.	Nitrate	10.0 mg/L
2.	Chloride	3.0 mg/L	6.	Phosphate	15.0 mg/L
3.	Nitrite	5.0 mg/L	7.	Sulfate	15.0 mg/L
4.	Bromide	10.0 mg/L			

Storage Solution: 0.1 M NaOH

Serial No. 1945 **Pressure (PSI)** 1090 **Date** 6/18/92

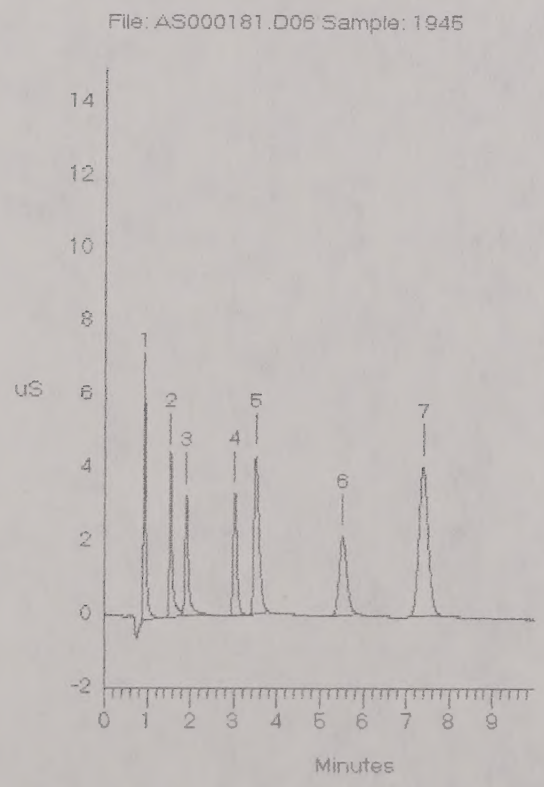
Dionex Corporation
IonPac AS4A-SC Analytical Column
Test Chromatogram

Sample Name: 1945 Date: 06/18/1992 11:26:36
Data File : C:\DX\DATA\AS4ASC\AS000181.D06
Method : C:\DX\METHOD\AS4ASC\AS4ASCR2.met
ACI Address: 1 System: 2 Inject#: 6 Vial: Detector:CDM-1
Analyst : Column:

********** Component Report: All Components **********

Pk. Num	Ret Time	Component Name	Efficiency	Asymmetry	Resolution
1	0.91	Fluoride	1429	4.43	6.25
2	1.53	Chloride	3602	2.54	3.19
3	1.90	Nitrite	3403	2.00	7.60
4	3.02	Bromide	5407	1.59	2.49
5	3.50	Nitrate	4016	2.41	7.39
6	5.51	Phosphate	4659	1.47	5.20
7	7.38	Sulfate	5542	1.28	0.00

Totals



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